

Patent claims

1. A surface-mountable miniature luminescent diode  
and/or photodiode with a chip package which has a  
5 leadframe (16), and  
a semiconductor chip (22) which is arranged on the  
leadframe (16) and is in electrical contact with it  
and which contains an active, radiation-emitting  
and/or radiation-receiving region,  
10 characterized in that the leadframe (16) is formed  
by a flexible multi-layered sheet (12, 14).
2. The surface-mountable miniature luminescent diode  
and/or photodiode as claimed in claim 1,  
15 characterized in that the flexible multi-layered  
sheet (12, 14) comprises a metal foil (12) and a  
plastic film (14) arranged on the metal foil and  
connected to it.
- 20 3. The surface-mountable miniature luminescent diode  
and/or photodiode as claimed in claim 2,  
characterized in that the plastic film (14) is  
adhesively bonded to the metal foil (12).
- 25 4. The surface-mountable miniature luminescent diode  
and/or photodiode as claimed in claim 2 or 3,  
characterized in that the metal foil (12) comprises  
a first chip connection region (18) and a second  
chip connection region (20), and in that the  
30 plastic film has openings (34, 36) in the regions  
arranged on these chip connection regions (18, 20).
5. The surface-mountable miniature luminescent diode  
and/or photodiode as claimed in claim 4,  
35 characterized in that the semiconductor chip (22)  
is arranged with a first contact area (24) on the  
first chip connection region (18), and is connected

with a second contact area (26) to the second chip connection region (20).

- 5       6. The surface-mountable miniature luminescent diode and/or photodiode as claimed in one of claims 2 to 5, characterized in that the thickness of the metal foil (12) is less than 80  $\mu\text{m}$ , in particular between 30  $\mu\text{m}$  and 60  $\mu\text{m}$  inclusive.
- 10      7. The surface-mountable miniature luminescent diode and/or photodiode as claimed one of claims 2 to 6, characterized in that the plastic film is formed by an epoxy resin film (14).
- 15      8. The surface-mountable miniature luminescent diode and/or photodiode as claimed in one of claims 2 to 7, characterized in that the thickness of the plastic film (14) is less than 80  $\mu\text{m}$ , in particular between 30  $\mu\text{m}$  and 60  $\mu\text{m}$  inclusive.
- 20      9. The surface-mountable miniature luminescent diode and/or photodiode as claimed in one of the preceding claims, characterized in that the semiconductor chip (22) is embedded in an encapsulating material (30).
- 25      10. The surface-mountable miniature luminescent diode and/or photodiode as claimed in one of the preceding claims, characterized in that the leadframe (16) has dimensions of approximately 0.5 mm  $\times$  1.0 mm or less.
- 30      11. The surface-mountable miniature luminescent diode and/or photodiode as claimed in one of the preceding claims, characterized in that the luminescent diode (10) has a total thickness of approximately 400  $\mu\text{m}$  or less, preferably of approximately 350  $\mu\text{m}$  or less.
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12. A method for producing a surface-mountable miniature luminescent diode and/or photodiode, in particular as claimed in one of the preceding claims, with the method steps of:
- 5       - providing a leadframe from a flexible multi-layered sheet which has a first chip connection region and a second chip connection region;
  - 10       - providing a semiconductor chip, which contains an active, radiation-emitting region and has a first contact area and a second contact area;
  - 15       - mounting the semiconductor chip with the first contact area on the first chip connection region of the leadframe;
  - 20       - connecting the second contact area to the second chip connection region of the leadframe; and
  - encapsulating the semiconductor chip with a transparent or translucent encapsulating material.
13. The method as claimed in claim 12, characterized in that the step of providing a leadframe comprises providing and punching a thin metal foil in order to define the first and second chip connection regions.
14. The method as claimed in claim 12 or 13, characterized in that the step of providing a leadframe comprises providing and punching a thin plastic film in order to define openings for the electrical connection of the semiconductor chip.
15. The method as claimed in claims 13 and 14, characterized in that the step of providing a leadframe comprises the adhesive bonding of the foil and the film.

16. The method as claimed in one of claims 12 to 15,  
characterized in that, in the encapsulating step,  
the encapsulating material is injection-molded,  
transfer-molded or sprayed onto the plastic film of  
5 the multi-layered sheet .
17. The method as claimed in one of claims 12 to 16,  
characterized in that, in the encapsulating step, a  
runner is led through a plurality of chips arranged  
10 on the multi-layered sheet.
18. The method as claimed in one of claims 12 to 17,  
characterized in that the first and second chip  
connection regions of the leadframe are short-  
15 circuited and grounded in the steps of mounting the  
semiconductor chip, connecting the second contact  
area and encapsulating the semiconductor chip.
19. The method as claimed in one of claims 12 to 18,  
20 characterized in that a plurality of chips arranged  
on the multi-layered sheet are tested for their  
functional capability after the encapsulating step  
and in that, for this purpose, the individual chips  
are electrically isolated when they are mounted.